

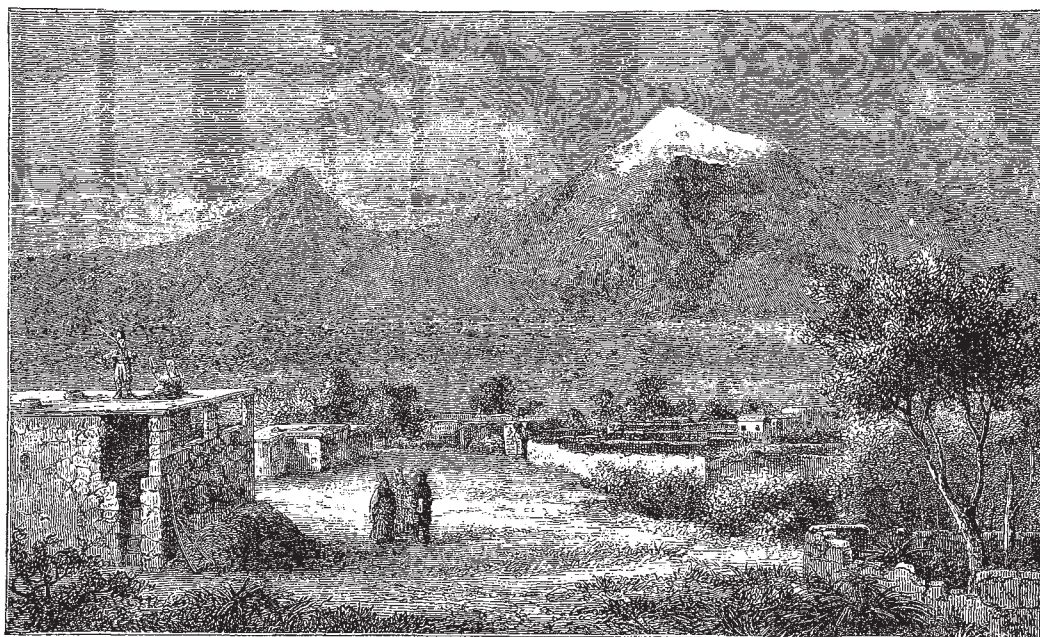
ARARAT¹

IN the childhood of mankind the dwellers in Western Asia cherished the story of a great flood which drowned all their race save one man and his family. They told the tale from father to son, how the flood rose till it covered their highest hills, and how the ark in which their ancestor had saved himself, his family, and a motley crowd of animals floated on the waters until, when these abated, it came to rest on the first emerging summit of the land. They chose as the scene of this new starting-point for humanity the loftiest peak of which they had knowledge—a vast snowy cone shooting far into the blue air above, and shrouding itself every day in cloud and storm. No one had ever climbed to its mysterious summit since the ark rested there. But generation after generation looked up to it with awe and veneration from the plains of Armenia. The story spread far away into other lands. It became part of the religious teaching of nearly a half of mankind. No mountain is so familiar, all the world over, as that from which Noah is famed to

have descended to re-people the earth. The first conception which, as children, most of us have formed of a mountain, arose out of this story of Ararat.

Apart from its legendary associations and the mystery arising from its reputed inaccessibility, there must be something strangely fascinating about Ararat. Men who have seen much of mountains in many countries speak of it as the noblest mass among them all. The summit of its snowy cone (17,000 feet) greatly exceeds any European peak in elevation, and sweeps up from the level plain of the Araxes (2,500 feet) as from a sheet of water. It looks as if it might well claim to be linked with the oldest of human traditions.

So impressive a mountain, so long associated with man's faith and history, would have been appropriately placed among the most ancient landscapes of the earth's surface. Some scenes suggest only the changes of yesterday; others set us thinking of the earliest condition of our world. We naturally look for a kind of consonance between the venerable antiquity of the associations which gather round Ararat and the primeval character of the



Great and Lesser Ararat from the North-east.

mountain itself. But geology delights in contrasts, and nowhere could so impressive a contrast be found between the remoteness of the tradition and the comparative youth of the mountain on which it lingers. Here we find no colossal pyramid of granite with outer folds of more ancient rocks such as have been built up and carved into the oldest mountain-chains. In reality it is but a mountain of yesterday, possibly not so old as the advent of man upon the earth, certainly much younger than many plants and animals now living.

To a student of the evolution of the earth's surface-features there is something profoundly suggestive in the long line of depressions and ridges which separates Europe from Africa, and stretches eastward through the heart of Asia. On the one hand, he sees the basins of the Mediterranean, Black, Dead, Caspian, and Aral Seas; on the other he notes how, in a general sense, parallel with these deep troughs, run massive mountain ridges, including the great axis of the Old World. He

finds, on closer research, that while most of these ridges have received their latest upheavals at a recent geological date, they yet for the greater part belong originally to earlier periods of disturbance, some of them, indeed, bearing witness to many successive uplifts during a vast section of geological time. Yet further examination will bring before him evidence that along some of these lines of earth-folding, volcanic action has of old been abundant; and that the present Mediterranean volcanoes are but the lingering remnants of the chain of actively burning mountains which ran through Asia Minor and crowned the peaks of the Caucasus. And he will discover that just as there have been successive uplifts of the same axis or mountain-chain, so have there been widely-separated outbursts of volcanic activity during a long course of ages from the same focus of discharge.

It is in relation to this remarkable history that Mount Ararat acquires its main geological interest. Thanks chiefly to the veteran Abich a good deal is now known of the geology of the Caucasian and Transcaucasian ridges. He has shown how a nucleus of Devonian and car-

¹ Transcaucasia and Ararat. By James Bryce. (London: Macmillan and Co., 1877.)

boniferous limestone rocks appears even under the mass of Ararat, and has drawn the inference from his wanderings in that region, that in the beginning of the Upper Carboniferous Limestone period a great continental upheaval took place during which the Armenian region received its first outlines. The land thus raised he believes to have remained above water until, in the course of the Cretaceous period, it so far sank as to become an island, and continued in this condition even into Pliocene times, when the whole of that region became involved in another vast continental upheaval to which the final modelling of the Armenian highlands was due. These great terrestrial movements were accompanied by the outbreak of volcanic action. Abich regards the diabase, diorite, and porphyry rocks as having been abundantly erupted during the Jurassic period and to have played an important part in the formation of the mountain masses, especially in the Lower Caucasus. To late Tertiary times, however, belong the trachytic and doleritic lavas which have been poured forth on so colossal a scale as to form such mountains as Elbruz, Kasbek, Ala Göz, and the two Ararats.

In Mr. Bryce's recently published volume (to which attention has already been drawn in NATURE) we have a record of the latest and probably the most daring ascent of Mount Ararat. Though not a professed geologist he has had a geological training, and has seen much of many lands, alike in the Old World and in the New. It was not to make out any obscure point in the structure of Ararat that he bent his steps towards that little known mountain. But he had climbed many a peak in Europe, and he no doubt longed to set foot upon the high places of another continent. So he made a pilgrimage to the heights of Armenia, with no thought, however, of writing a book about his journey. The volume he has just published has been partly wrung from him by the importunity of friends, who reasonably supposed that the world might be as much interested as they in knowing more about Ararat. In its charmingly fresh and graphic pages one gets such a living picture of the mountain as cannot be gained from any of the geological memoirs. From long experience of mountain climbing his eyes are so keen and so trained, while his pen is so facile and vivid that we can mount with him as he goes warily over each lava-current, rubbish-cone, and snow-slope. We feel the sharp thin air of the mountain as it blows through his narrative. We join in his quiet chuckle as he halts at a solitary piece of wood far up on the cone and irreverently detaches a fragment for the inspection of those who cannot personally discover whether the true ark still rests on the top of Ararat. And we can sympathise with his awe as he stood among the clouds alone on the summit of the mysterious mountain. It is not for any new scientific facts so much as for the vivid sketch of the general aspect of the huge volcanic mass that his book has an interest to geologists.

A vignette of Ararat forms the frontispiece of the volume, which is here reproduced. In the middle distance is shown the alluvial plain of the Araxes. Below the snowy cone and icy cliffs of the Greater Ararat a deep cleft or recess appears with huge cliffs somewhat like the Val del Bove of Etna, and no doubt due to some of the volcanic explosions of the mountain. On the skyline of this slope, towards the base of the larger cone, some of the late cinder-cones and craters appear. Some of these are still so fresh and perfect that they look as if they had been active only the other day and might blaze forth again to-morrow. The graceful outline of the Lesser Ararat rises on the left. ARCH. GEIKIE

AGE OF THE SUN IN RELATION TO EVOLUTION

ONE of the most formidable objections to the theory of evolution is the enormous length of time which it demands. On this point Prof. Haeckel, one of the

highest authorities on the subject, in his "History of Creation," has the following:—"Darwin's theory, as well that of Lyell, renders the assumption of immense periods absolutely necessary. . . . If the theory of development be true at all there must certainly have elapsed immense periods, utterly inconceivable to us, during which the gradual historical development of the animal and vegetable proceeded by the slow transformation of species. . . . the periods during which species originated by gradual transmutation, must not be calculated by single centuries, but by hundreds and by millions of centuries. Every process of development is the more intelligible the longer it is assumed to last."

There are few evolutionists, I presume, who will dispute the accuracy of these statements; but the question arises, does physical science permit the assumption of such enormous periods? We shall now consider the way in which Prof. Haeckel endeavours to answer this question and to meet the objections urged against the enormous lapse of time assumed for evolution.

"I beg leave to remark," he says, "that we have not a single rational ground for conceiving the time requisite to be limited in any way. . . . It is absolutely impossible to see what can in any way limit us in assuming long periods of time. . . . From a strictly philosophical point of view it makes no difference whether we hypothetically assume for this process ten millions or ten thousand millions of years. . . . In the same way as the distances between the different planetary systems are not calculated by miles but by Sirius-distances, each of which comprises millions of miles, so the organic history of the earth must not be calculated by thousands of years, but by palaeontological or geological periods, each of which comprises many thousands of years, and perhaps millions or milliards of thousands of years."

Statements more utterly opposed to the present state of modern science on this subject could hardly well be made. Not only have physicists fixed a limit to the extent of time available to the evolutionist, but they have fixed it within very narrow boundaries.

Every one will admit that the organic history of our globe must have been limited by the age of the sun's heat. The extent of time that the evolutionist is allowed to assume depends, therefore, on the answer to the question, What is the age of the sun's heat? And this again depends on the ulterior question, From what source has he derived his energy? The sun is losing heat at the enormous rate of 7,000 horse-power on every square foot of surface. And were it composed of coal its combustion would not maintain the present rate of radiation for 5,000 years. Combustion, therefore, cannot be the origin of the heat.

Gravitation is now almost universally appealed to as the only conceivable source from which the sun could have obtained his energy. The contraction theory advocated by Helmholtz is the one generally accepted, but the total amount of work performed by gravitation in the condensation of the sun from a nebulous mass to its present size could only have afforded twenty million years' heat at the present rate of radiation. On the assumption that the sun's density increases towards the centre, a few additional million years' heat might be obtained. But on every conceivable supposition gravitation could not have afforded more than twenty or thirty million years' heat.

Prof. Haeckel may make any assumption he chooses about the age of the sun, but he must not do so in regard to the age of the sun's heat. One who believes it *inconceivable* that matter can either be created or annihilated may be allowed to maintain that the sun existed from all eternity, but he cannot be permitted to assume that our luminary has been losing heat from all eternity.

If 20,000,000 or 30,000,000 years do not suffice for the evolution theory, then either that or the gravitation theory of the origin of the sun's heat will have to be abandoned.

In a former paper (*Quarterly Journal of Science* for